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"STUDY ON HYDROGEOCHEMISTRY, TRACE ELEMENT CONCENTRATION AND MICROPLASTIC POLLUTION FROM THE BOTTOM SEDIMENTS OF NETRAVATHI-GURUPURA ESTUARY,SOUTHWEST COAST OF INDIA"

In
Marine Geology

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INTRODUCTION

Any particle or material that, simply by being present, pollutes the environment is referred to be a pollutant. These contaminants can have either natural or manmade sources, but artificial sources are more common than natural sources. Heavy metals, microplastics (MPs), phthalates, perfluoroalkyl substances (PFAS), pesticides, medical waste, microorganisms, fluoride, and other pollutants are examples of general pollutants. Although pollution is different from contamination, contaminants can also be pollutants and harm the environment. According to literature, pollution is the introduction of substances or energy into the environment by humans, either directly or indirectly, which has the negative consequences of harming living things, endangering human health, impeding environmental activities, degrading the quality of the environment for human use, and reducing amenities. On the other hand, contamination refers to the existence of high quantities of substances in the environment that are above the area's and an organism's respective natural background levels. An undesired alteration in the physical, chemical, or biological properties of the air, water, or soil that is hazardous to both plants and animals is referred to as environmental pollution. Chemical substances or energy, such as sound, heat, or light, can be pollutants (Wong, 2013). Both naturally occurring contaminants and alien substances/energies can be pollutants, which are the ingredients of pollution.

Toxic substances that are persistent pollutants harm both the environment and human health worldwide. Due to their potential for long-distance spread, environmental durability, capacity to bio-magnify and bio-accumulate in ecosystems, and major detrimental effects on both human health and the environment, they are of increased global concern. Most persistent pollutants produced in one nation can and do damage people and wildlife far from where they are utilized and emitted because they can be carried through the atmosphere and water. They can

Collect and spread across the food chain from one species to the next for extended periods.

STUDY AREA:

Dakshina Kannada is a maritime district located in the south-western part of Karnataka state adjoining the Arabian Sea. The geographical area is 4770 sq. km the study area lies in between **12° 56'12''& 12° 57' 59''** North latitude and **74° 47' 57''& 74°, 48', 09''** East longitude. Mangalore town is the district headquarters. Administratively, the district is divided into five taluks viz. Bantwal, Belthangady, Mangalore, Puttur, and Sulya.

The Netravathi and Gurupura rivers originate on the steep slopes of the Sahyadri hill ranges (Western Ghats) at 900-1800 m above the mean sea level (MSL). The Netravathi River debouches into the Arabian Sea in the south of the New Mangalore Port (NMP) approximately at right angle, whereas the Gurupura River runs parallel to the coast for a distance of about 8 km and meets with the Netravathi River. During their westward flow, they pass through an undulating lateritic terrain and over the low-lying coastal plains. The drainage area of the N-G Rivers is 3,433 and 824 km^2.

The river Nethravathi has its origins at Bangrabalige Valley, Yelaneeru Ghat in Kudremukh in Chikkamagaluru district of Karnataka state. This river flows through the famous pilgrimage place Dharmasthala and is considered one of the holy river of Karnataka. It merges with the Kumaradhara River at Uppinangadi before flowing to the Arabian Sea, south of Mangalore city. This river is the main source of water for Bantwal and Mangalore. The Gurupura River originates in the Western Ghats and is a tributary of the Netravathi River, which empties into the Arabian Sea, south of Mangalore. It gets its name from the town of Gurupura, situated near.

Mangalore. The New Mangalore Port and Mangalore Chemicals and Fertilizers are situated on its northern banks.

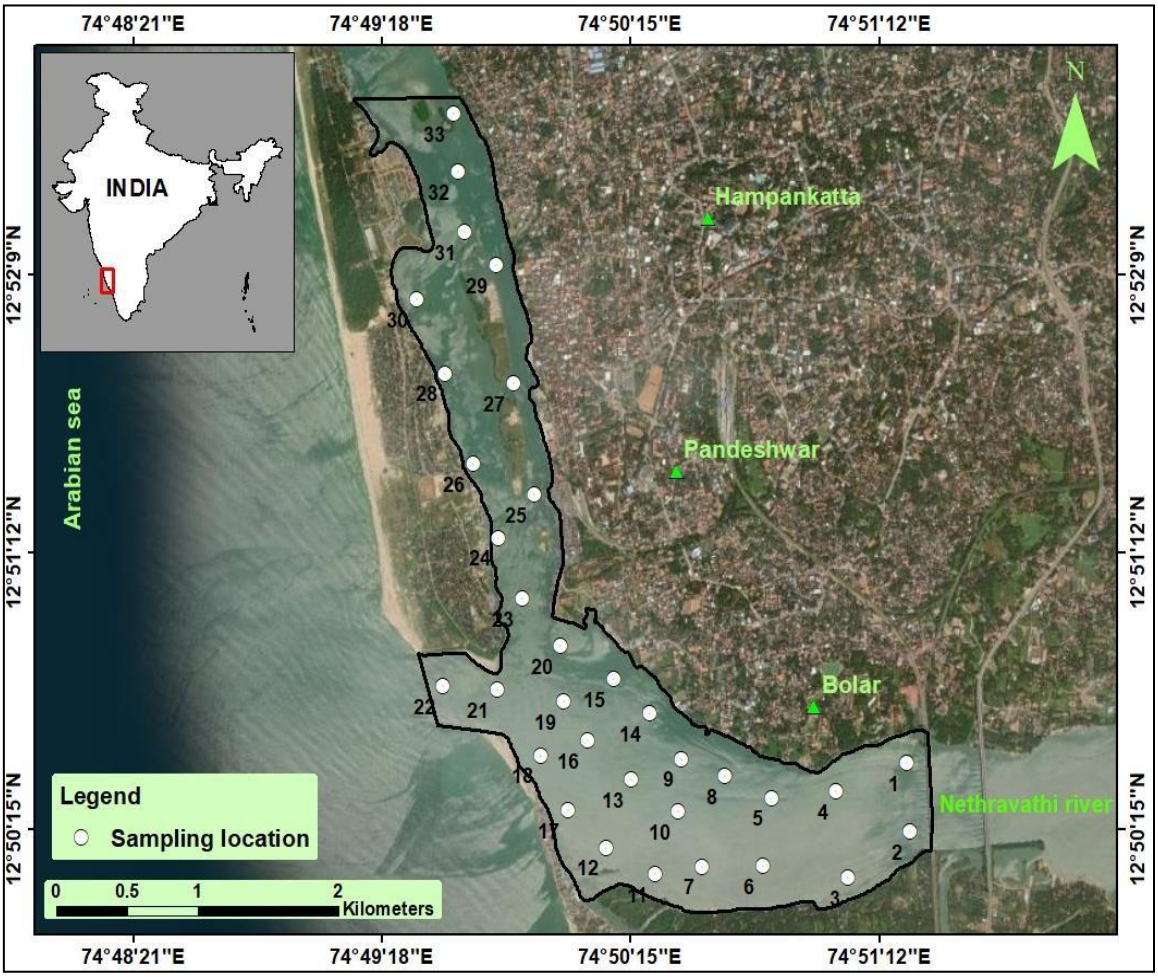

Fig.1. Location map of the study area

Climate:

Mangalore has a tropical monsoon climate and is under the direct influence of the Arabian Sea branch of the southwest monsoon. It receives about 95 per cent of its total annual rainfall between May to October but remains extremely dry from December to March. The average annual precipitation in Mangalore is 3,796.9 millimetres Humidity is approximately 75 per cent on average and peaks during June, July and August. The maximum average humidity is 93 per cent in July and the average minimum humidity is 56 per cent in January.

Physiographic: a) Coastal Plain b). Western Ghat Region c). Upland Pediplain area.

GEOLOGY

Geologically the area is characterized by extensively developed laterites on both Archaean as well as Tertiary litho units. The area (Dakshina Kannada coastal tract) forms the westernmost part of the Western Ghat Belt (also termed, West Coast Belt) of Karnataka craton. The Western Ghat Belt could be divided into two divisions based both on Physiography as well as geology: (1) the Western Ghat proper and (2) the coastal tract.

SCOPE OF THE STUDY

The studies contemplated would reveal the data concerning the occurrence and behavioural aspects of trace elements and microplastics in the surface sediments and sediment cores collected from the study area. Secondly, they would prove significant in deciphering the environmental implications, which is found to be the main objective of the work to present detailed descriptions and illustrations to finally amplify the ecologic regimes of the area. It may ultimately be pointed out that the present research acquired might prove significant and form a strong baseline data for future programs.

OBJECTIVES:

The following are the major objectives of the present study.

1. To determine the environmental parameters and depositional characteristics. Sediment Texture, Organic Matter, and Calcium Carbonate and analysis of physicochemical parameters of surface water.

2. To identify the possible ecological pollution source from surface sediments of trace elements Concentration.

3. To estimate the pollution status of the estuary from Microplastics.

FIELDWORK

The fieldwork was carried out during the month of **May (2021) and December (2021),** representing Pre-monsoon and Post-monsoon respectively. A total number of 33 surface sediment samples for two seasons and 2 Core samples were collected from the estuary and mangrove locations with the help of grab and by using 6 cm diameter PVC pipe. GPS is used to recordthe sampling sites.

METHODOLOGY

The fieldwork was carried out during the month of **May and December 2021; a** total number of 33 surface sediment samples and 2 Core samples were collected from the Netravathi and Gurupura estuaries. The surface sediment samples were collected from the estuary and mangrove Locations with the help of a Van-Veen grab sampler and by using a 6 cm diameter and 3 m PVC pipe. An equal number of water samples will also be collected from the estuarine region.

Calcium carbonate is often an important component of marine sediments and has been determined by the author using the rapid titration method (Piper, 1947). Organic matter contentis determined by the procedure suggested by Gaudette *et al.* (1974). Fine fractions (sand, silt and clay) in the washings are analysed by the pipette method by the procedure adopted by Krumbein and Pettijohn (1938). The sediment type was classified by Trefethen‟s (1950) classification. The trace element analysis was adopted after Hussain *et al.,* 2020 by using the open acid digestion method. The microplastic analysis was done after the NOAA protocol (Masura *et al.,* 2015).

EXPECTED OUTCOME OF THE PRESENT RESEARCH INVESTIGATION

The sediments in the chosen **Netravathi and Gurupura estuary** along Karnataka's southwest coast were subjected to tests to establish the ecological risk status for a variety of pollutants, including trace elements and microplastics. The findings from these proxies, the ecology of the chosen estuary will be assessed in a risk position generally. The environment compartments will be negatively impacted by even a nano level of its existence. It has also been noted that other water pollutants, such as dyes, heavy metals, and other chemicals, may easily connect with microplastics, and these microplastics also serve as a carrier of other pollutants in the bodies of aquatic creatures, which further infiltrate the food chain. Many of these pollutants don't have any standard limits or threshold limits set by different organizations, thus in the next years, these pollutants need to be closely monitored.

Order of Presentations:

The result of the present investigations has been presented in the form of the Thesis addressed into 8 chapters as follows:

Chapter 1: is concerned with the introduction about Estuaries, Pollutants, Heavy metals and Microplastics describes the rationale behind the decision to pursue this issue as well as general features studies about Hydro geochemistry of the research study area.

Chapter 2: Literature survey about Environmental parameters, Trace Elements Geochemistry, Hydro geochemistry and Microplastics.

Chapter 3: Discusses the Material and Methodology the of present study area Includes Field work, Sediment characteristics, Determination of sand, silt and clay ratio**,** Determination of Calcium Carbonate, Determination of readily oxidizable organic matter, Hydro geochemistry and Microplastic Separation.

Chapter 4: Deals with Sediment Texture, Organic Matter and Calcium Carbonate and also maps have been prepared in Arc Map 10.3 software.

Chapter 5: Describes Hydrogeochemistry. The Surface water samples of different locations have been collected and analyzed for various hydro-geochemical parameters viz., TDS, TH, DO and pH along with ions like Ca, Mg, CO3 HCO3, and CI and also, maps have been prepared in Arc map 10.3 software.

Chapter 6: Discusses with Distribution of Iron (Fe), Manganese (Mn), Lead (Pb), Zinc (Zn), Copper (Cu), Cobalt (Co), Cadmium (Cd), Nical (Ni) and Chromium (Cr). And also Research about Environmental Pollution Impact Enrichment Factor (EF), Contamination Factor (CF), Geo-accumulation index (I_{geo}), Pollution Load Index (PLI), Sediment Pollution Index (SPI) and Potential Ecological Risk Index (PERI).Also, maps have been prepared in Arc Map 10.3 software.

Chapter 7: Discusses about Distribution of Microplastic in Sediment Substrate. Research has been carried out on the Source classification of **Microplastic**, colour of MPs, Shape of MPs, Size of MPs, Composition classification of microplastics, Comparative result, Risk assessment of MPs in Sediments, comparative investigation on the distribution of microplastics in different estuaries around the world.

Chapter 8: deals with Summary and Conclusions. The summary of the present work along with an important conclusion arrived and presented.

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Signature of the Candidate **Signature of the Guide**

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